

1    **CLAIMS**

2    We claim:

3

4    1.     A computer-accessible medium comprising:  
5           a translator that is operable to receive a non-procedural image annotation  
6                 template, the translator being operable to translate the non-procedural  
7                 image annotation template to image annotation source code; and  
8           a compiler operably coupled to the translator, the compiler being operable to  
9                 receive the image annotation source code and to compile the source  
10                code into an image annotation executable.

11

12   2.     The computer-accessible medium of claim 1, wherein the non-procedural  
13   image annotation template further comprises a mixture of XML and conventional  
14   numerical expressions based on C language syntax.

15

16   3.     The computer-accessible medium of claim 1, wherein the image annotation  
17   executable further comprises an annotation presentation description.

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19   4.     The computer-accessible medium of claim 1, wherein the translator further  
20   comprises:

21           an iterator object for an expression tree of the non-procedural image  
22                 annotation template; and

23           a lexical analyzer of the procedural image annotation template.

24

25   5.     The computer-accessible medium of claim 1, wherein the image annotation  
26   source code further comprises an object-oriented image annotation source code and  
27   the compiler further comprises an object-oriented compiler.

28

29   6.     The computer-accessible medium of claim 5, wherein the object-oriented  
30   image annotation source code further comprises Java image annotation source code  
31   and the object-oriented compiler further comprises a Java compiler.

1     7.     The computer-accessible medium of claim 1, wherein the image annotation  
2     executable further comprises instructions that are native to the processor of a medical  
3     imaging system.

4  
5     8.     A computer-accessible medium having executable instructions to generate an  
6     image annotation executable from a non-procedural image annotation template to  
7     annotate images, the executable instructions capable of directing a processor to  
8     perform:

9             translating the non-procedural image annotation template to image annotation  
10            source code, wherein non-procedural image annotation template  
11            comprises non-procedural expression of calculations and operations to  
12            annotate an image with embedded text and wherein the procedural  
13            image annotation source code comprises procedural expression of the  
14            calculations and operations to annotate an image with embedded text;  
15            and  
16            compiling the image annotation source code into an image annotation  
17            executable.

18  
19     9.     The computer-accessible medium of claim 8, wherein the compiling further  
20     comprises:

21             targeting the compiling to an instruction set of a processor of an imaging  
22             system.

23  
24     10.    The computer-accessible medium of claim 8, further comprising executable  
25     instructions capable of directing a processor to perform:

26             transferring the image annotation executable to an imaging system.

27  
28     11.    The computer-accessible medium of claim 10, wherein the imaging system is  
29     a medical imaging system.

30  
31     12.    The computer-accessible medium of claim 8, wherein the non-procedural  
32     image annotation template is written in a language that does not require procedural

1 operations and wherein the procedural image annotation source code further  
2 comprises calculations and operations to annotate an image with embedded text.

3  
4 13. A development system comprising:  
5 means for translating the non-procedural image annotation template to image  
6 annotation source code, wherein non-procedural image annotation  
7 template comprises non-procedural expression of calculations and  
8 operations to annotate an image with embedded text and wherein the  
9 procedural image annotation source code comprises procedural  
10 expression of the calculations and operations to annotate the image  
11 with the embedded text; and  
12 means for compiling the image annotation source code into a medical image  
13 annotation executable, to an instruction set of a processor of an  
14 medical imaging system.

15  
16 14. The development system of claim 13, further comprising:  
17 means for transferring the image annotation executable to an imaging system.

18  
19 15. The development system of claim 13, wherein the non-procedural image  
20 annotation template is written in a language that does not require procedural  
21 operations and wherein the procedural image annotation source code further  
22 comprises calculations and operations to annotate an image with embedded text.

23  
24 16. A translator recorded on a computer-accessible medium, the translator being  
25 operable to receive a non-procedural image annotation template and to translate the  
26 non-procedural image annotation template to Java source code, the translator  
27 comprising:

28 a parser of the non-procedural image annotation template; and  
29 a translator of the parsed non-procedural image annotation template to the  
30 Java source code.

- 1    17.    The translator of claim 16, wherein the parser of the non-procedural image  
2    annotation template further comprises:  
3            an initiator of a parser of the non-procedural image annotation template, the  
4            parser being compliant with the Simple API for XML standard;  
5            an element starter;  
6            an element parser;  
7            an element ender; and  
8            an element attacher.  
9
- 10   18.    The translator of claim 16, wherein the translator of the parsed non-procedural  
11   image annotation template further comprises:  
12            a writer of Java class package source code;  
13            a writer of Java import statement source code;  
14            a writer of Java class declaration source code;  
15            a writer of Java variable declaration source code; and  
16            a filler of hash table representing at least one DICOM element of the Java  
17            source code.  
18
- 19   19.    The translator of claim 18, wherein the filler of hash tables representing  
20   elements of the Java source code further comprises:  
21            a writer of Java source code that constructs a group tree as described by the  
22            elements of the non-procedural image annotation template;  
23            a writer of Java source code that loads assigner attributes in an ApStyle object  
24            and hashes with instances of run-time class declarations;  
25            a writer of Java source code that loads a data structure adapted for storage of  
26            DICOM elements with all DICOM elements that are required for  
27            annotation;  
28            a writer of Java source code that loads the data structure adapted for tool-tip  
29            data with character strings;  
30            a writer of Java source code that initializes a layout data structure that is  
31            designed to hold annotation strings for each quadrant, line, and  
32            segment;

1 a writer of Java source code that invalidates all variable contents, as one would  
2 use if this object was assigned to control annotation of another image;  
3 a writer of Java source code that generates comments that document a runtime  
4 variable updates object; and  
5 a writer of Java source code that evaluates expressions in order of  
6 dependencies.

7

8 20. A computer-accessible medium having executable instructions to translate a  
9 non-procedural image annotation template to Java source code, the executable  
10 instructions capable of directing a processor to perform:

11 parsing the non-procedural image annotation template comprising  
12 initializing a parser of the non-procedural image annotation template,  
13 the parser being compliant with the Simple API for XML  
14 standard;  
15 starting an element of the non-procedural image annotation template;  
16 parsing an element of the of the non-procedural image annotation  
17 template using the parser;  
18 ending an element of the non-procedural image annotation template;  
19 and  
20 attaching the parsed element,  
21 repeating the starting, parsing, ending and attaching for each element  
22 of the non-procedural image annotation template, yielding a  
23 parsed non-procedural image annotation template,  
24 the translating further comprising:  
25 translating the parsed non-procedural image annotation template to  
26 Java source code.

27

28 21. The computer-accessible medium of claim 20, wherein the translating of the  
29 parsed non-procedural image annotation template further comprises:

30 writing a Java class package;  
31 writing Java import statements;  
32 writing Java class declarations;

1 writing Java variable declarations; and  
2 filling hash tables representing DICOM elements of the Java source code.  
3

4 22. The computer-accessible medium of claim 20, wherein the non-procedural  
5 image annotation template further comprises a mixture of XML and conventional  
6 numerical expressions based on C language syntax.  
7

8 23. A method to translate a non-procedural image annotation template to Java  
9 source code, the translator comprising:

10 parsing the non-procedural image annotation template comprising  
11 initializing a parser of the non-procedural image annotation template,  
12 the parser being compliant with the Simple API for XML  
13 standard;  
14 starting an element of the non-procedural image annotation template;  
15 parsing an element of the of the non-procedural image annotation  
16 template using the parser;  
17 ending an element of the non-procedural image annotation template;  
18 and  
19 attaching the parsed element,  
20 repeating the starting, parsing, ending and attaching for each element  
21 of the non-procedural image annotation template, yielding a  
22 parsed non-procedural image annotation template,  
23 the translating further comprising:  
24 translating the parsed non-procedural image annotation template to  
25 Java source code.  
26

27 24. The method of claim 23, wherein the translating of the parsed non-procedural  
28 image annotation template further comprises:

29 writing a Java class package;  
30 writing Java import statements;  
31 writing Java class declarations;  
32 writing Java variable declarations; and

1           filling hash tables representing DICOM elements of the Java source code.

2

3   25.    The method of claim 23, wherein the non-procedural image annotation  
4   template further comprises a mixture of XML and conventional numerical expressions  
5   based on C language syntax.

6

7   26.    A Java-based system comprising:

8           means for parsing the non-procedural image annotation template comprising:

9                means for initializing a parser of the non-procedural image annotation  
10               template, the parser being compliant with the Simple API for  
11               XML standard;

12           means for starting an element of the non-procedural image annotation  
13           template;

14           means for parsing an element of the of the non-procedural image  
15           annotation template using the parser;

16           means for ending an element of the non-procedural image annotation  
17           template; and

18           means for attaching the parsed element,

19           means for repeating the starting, parsing, ending and attaching for each  
20           element of the non-procedural image annotation template,  
21           yielding a parsed non-procedural image annotation template,

22   the Java-based system further comprising means for translating comprising:

23           means for writing a Java class package;

24           means for writing Java import statements;

25           means for writing Java class declarations;

26           means for writing Java variable declarations; and

27           means for filling hash tables representing DICOM elements of Java  
28           source code.

29

30   27.    The Java-based system of claim 26, wherein the non-procedural image  
31   annotation template further comprises a mixture of XML and conventional numerical  
32   expressions based on C language syntax.

1

2   28.    A computer-accessible medium comprising:  
3           a template repository that is operable to store one or more non-procedural  
4                image annotation templates;  
5           a storer of the one or more non-procedural image annotation templates,  
6                operably coupled to the template repository; and  
7           a selector of the one of the non-procedural image annotation templates,  
8                operably coupled to the template repository.

9

10   29.   The computer-accessible medium of claim 28, wherein the one or more non-  
11           procedural image annotation templates further comprises a computed  
12           tomography non-procedural image annotation template.

13

14   30.    The computer-accessible medium of claim 27, wherein the one or more non-  
15           procedural image annotation templates further comprises a magnetic-  
16           resonance non-procedural image annotation template.

17

18   31.    A computer-accessible medium having executable instructions to generate an  
19           image annotation executable from a non-procedural image annotation template to  
20           annotate images, the executable instructions capable of directing a processor to  
21           perform:

22                storing the one or more non-procedural image annotation templates in a  
23                        template repository, and  
24                selecting one of the non-procedural image annotation templates in the template  
25                        repository.

26

27   32.    The computer-accessible medium of claim 31, wherein the one or more non-  
28           procedural image annotation templates further comprises a computed  
29           tomography non-procedural image annotation template.

30



- 1    33.    The computer-accessible medium of claim 31, wherein the one or more non-  
2           procedural image annotation templates further comprises a magnetic-  
3           resonance non-procedural image annotation template.  
4
- 5    34.    A computer-accessible medium comprising:  
6           an image annotation executable; and  
7           an image viewer, operable to receive the image annotation executable, an  
8           image and an image annotation object, the image annotation object  
9           containing text, the image viewer being operable to execute  
10          instructions contained in the image annotation executable and using  
11          text from the image annotation object, and the image viewer being  
12          operable to generate an annotated image that is annotated with the text  
13          from the image annotation object.  
14
- 15   35.    The computer-accessible medium of claim 34, wherein the instructions further  
16          comprise computer instructions that are native to a processor, the processor being  
17          operably coupled through a bus to the computer-accessible medium.  
18
- 19   36.    The computer-accessible medium of claim 34, wherein the image annotation  
20          executable further comprises an image annotation executable that is compiled from a  
21          non-procedural image annotation template.  
22
- 23   37.    The computer-accessible medium of claim 34, wherein the image annotation  
24          executable further comprises an annotation presentation description.  
25
- 26   38.    The computer-accessible medium of claim 34, wherein the image annotation  
27          object further comprises the image.  
28
- 29   39.    The computer-accessible medium of claim 37, wherein the image annotation  
30          object further comprises an image annotation object that conforms to standard that  
31          defines data elements in object-oriented terms, each object having a unique tag, name,  
32          characteristics and semantics.

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40. The computer-accessible medium of claim 34, wherein the image further comprises an unannotated image.
41. The computer-accessible medium of claim 34, wherein the image annotation executable further comprises:
- an object to select a style class object that is appropriate for imaging of a modality; and
  - an instantiated style class object.
42. The computer-accessible medium of claim 41, wherein the modality is selected from a group consisting of magnetic resonance, computed tomography, X-ray, ultrasound and positron emission tomography.
43. The computer-accessible medium of claim 41, wherein the viewer further comprises:
- an object to invoke one or more methods in the object that selects a style class object that is appropriate for imaging of a modality; and
  - an object to receive parsed annotation data and the image from the image annotation object through a host image annotation parser, and to forward the image and text to the style class object that is appropriate for imaging of a modality.
44. The computer-accessible medium of claim 43, wherein the style class object that is appropriate for imaging of a modality further comprises:
- a method to forward the image and text to a host text drawer in the viewer; and
  - a method to forward the image and text to a graphic utilities object that is native to an operating system that is running on a processor that is operably coupled to the computer-accessible medium, whereupon the graphic utilities object is to generate the annotated image.

1 45. A computer-accessible medium having executable instructions to generate and  
2 view an annotated medical image, from an image annotation object and an annotation  
3 presentation description, the image annotation object having an image, the annotation  
4 presentation description having instructions that are native to a processor that is  
5 operably coupled to the computer accessible medium, the executable instructions  
6 capable of directing the processor to perform:

7 receiving the annotation presentation description and the image annotation.

8 object; and

9 invoking the native instructions contained in the annotation presentation  
10 description and using text from the image annotation object, to  
11 generate and view the annotated medical image that is annotated with  
12 the text from the image annotation object.

13  
14 46. The computer-accessible medium of claim 45, wherein the annotation  
15 presentation description further comprises an annotation presentation description that  
16 is compiled from a non-procedural image annotation template.

17  
18 47. The computer-accessible medium of claim 45, wherein the image annotation  
19 object further comprises an image annotation object that conforms to standard that  
20 defines data elements in object-oriented terms, each object having a unique tag, name,  
21 characteristics and semantics.

22  
23 48. The computer-accessible medium of claim 45, wherein the annotation  
24 presentation description further comprises executable instructions capable of directing  
25 the processor to perform:

26 selecting a style class object that is appropriate for imaging of a modality; and  
27 instantiating the selected style class object.

28  
29 49. The computer-accessible medium of claim 48, wherein the modality is  
30 selected from a group consisting of magnetic resonance, computed tomography, X-  
31 ray, ultrasound and positron emission tomography.

1 50. The computer-accessible medium of claim 45, wherein the executable  
2 instructions further comprise executable instructions capable of directing the  
3 processor to perform:

4 receiving parsed annotation data and the image from the image annotation  
5 object through a host image annotation parser; and  
6 forwarding the image and text to a graphic utilities object that is native to an  
7 operating system that is running on the processor, whereupon the  
8 graphic utilities object is to generate and view the annotated image.  
9

10 51. A method to generate and view an annotated medical image, from an image  
11 annotation object having an image and an annotation presentation description,  
12 wherein the annotation presentation description further comprises an annotation  
13 presentation description that is compiled from a non-procedural image annotation  
14 template and has instructions that are native to a processor that is operably coupled to  
15 the computer accessible medium, the method comprising:

16 receiving the annotation presentation description and the image annotation  
17 object, the image annotation object containing text; and  
18 invoking the native instructions contained in the annotation presentation  
19 description and using text from the image annotation object, to  
20 generate and view the annotated medical image that is annotated with  
21 the text from the image annotation object.  
22

23 52. The method of claim 51, wherein the image annotation object further  
24 comprises an image annotation object that conforms to the Digital Imaging and  
25 Communications in Medicine standard.  
26

27 53. The method of claim 51, further comprising:  
28 selecting a style class object that is appropriate for imaging of a modality,  
29 wherein the modality is selected from a group consisting of magnetic  
30 resonance, computed tomography, X-ray, ultrasound and positron  
31 emission tomography; and  
32 instantiating the selected style class object.

1

2    54.    The method of claim 51, further comprising:  
3            receiving parsed annotation data and the image from the image annotation  
4            object through a host image annotation parser; and  
5            forwarding the image and text to a graphic utilities object that is native to an  
6            operating system that is running on the processor, whereupon the  
7            graphic utilities object is to generate the annotated image.

8

9    55.    A Java-based system to generate and view an annotated medical image, from  
10    an annotation presentation description and an annotation object, wherein the  
11    annotation object conforms to the Digital Imaging and Communications in Medicine  
12    standard and has an image, wherein the annotation presentation description further  
13    comprises an annotation presentation description compiled from a non-procedural  
14    image annotation template and has instructions that are native to a processor, the  
15    system comprising:

16           Java-based means for receiving the annotation presentation description and the  
17           image annotation object, the image annotation object containing text;  
18           and

19           Java-based means for invoking the native instructions contained in the  
20           annotation presentation description and using text from the image  
21           annotation object, to generate and view the annotated medical image  
22           that is annotated with the text from the image annotation object.

23

24    56.    The Java-based system of claim 55, further comprising:

25           Java-based means for selecting a style class object that is appropriate for  
26           imaging of a modality, wherein the modality is selected from a group  
27           consisting of magnetic resonance, computed tomography, X-ray,  
28           ultrasound and positron emission tomography;

29           Java-based means for instantiating the selected style class object;

30           Java-based means for receiving parsed annotation data and the image from the  
31           image annotation object through a host image annotation parser; and

1           Java-based means for forwarding the image and text to a graphic utilities  
2           object that is native to an operating system that is running on the  
3           processor, whereupon the graphic utilities object is to generate the  
4           annotated image.

5  
6    57.    A computer system comprising:  
7           a processor;  
8           a bus operably coupled to the processor and  
9           a computer-accessible medium comprising a viewer that is operable to access  
10          computer instructions that are native to the processor, the computer  
11          instructions having been generated by a processor on another computer  
12          system, the computer-accessible medium being operably coupled to the  
13          processor through the bus.

14  
15   58.    The computer system of claim 57, wherein the viewer further comprises a  
16    browser and the computer instructions further comprise computer instructions  
17    encapsulated in a browser plug-in component.

18  
19   59.    A computed tomography imaging system comprising:  
20          a processor;  
21          a bus operably coupled to the processor and  
22          a computer-accessible medium comprising a viewer that is operable to access:  
23          objects that conform to the Digital Imaging and Communications in  
24          Medicine standard, the objects comprising an image and an  
25          annotation presentation description; and  
26          computer instructions that are native to the processor, the computer  
27          instructions having been generated by a processor on another  
28          system, the computer-accessible medium being operably  
29          coupled to the processor through the bus.

30

1 60. The computed tomography imaging system of claim 59, wherein the viewer  
2 further comprises a browser and the computer instructions further comprise computer  
3 instructions encapsulated in a browser plug-in component.  
4

5 61. The computer system of claim 59, wherein the computer instructions further  
6 comprise computer instructions encapsulated in a dynamic link library.  
7

8 62. A computer-accessible medium comprising:  
9 an encapsulation of image annotation computer instructions; and  
10 a viewer that is operable to access the encapsulated image annotation  
11 computer instructions.  
12

13 63. The computer-accessible medium of claim 62 wherein the encapsulated image  
14 annotation computer instructions further comprise arithmetic calculations and special  
15 string operations for annotation that are native to a processor that is operably coupled  
16 to the computer-accessible medium.  
17

18 64. A computer-accessible medium having executable instructions to generate an  
19 annotated image, the executable instructions capable of directing a processor to  
20 perform:  
21 invoking executable instructions that are native to the processor, the  
22 executable instructions being contained in an image annotation  
23 executable, wherein operands to the native computer instructions  
24 include text; and  
25 generating an annotated image that is annotated with the text from the image  
26 annotation object.  
27

28 65. The computer-accessible medium of claim 64, wherein the executable  
29 instructions further comprise executable instructions capable of directing the  
30 processor to perform displaying the annotated image on a visual display in a browser.  
31

1 66. The computer-accessible medium of claim 65, wherein the image annotation  
2 object further comprises an object that is encoded according to a standard that defines  
3 data elements in object-oriented terms, each object having a unique tag, name,  
4 characteristics and semantics.

5  
6 67. The computer-accessible medium of claim 65, wherein the original image  
7 further comprises an original unannotated medical image.

8  
9 68. The computer-accessible medium of claim 65, wherein the original image  
10 further comprises an original image contained with the image annotation object.

11  
12 69. The computer-accessible medium of claim 65, wherein the image annotation  
13 executable further comprises an annotation presentation description.

14  
15 70. A computer-accessible medium having executable instructions to generate an  
16 annotated medical image, an image annotation object and an annotation presentation  
17 description, the executable instructions capable of directing a processor to perform:  
18 invoking executable instructions that are native to the processor, the  
19 executable instructions being contained in the annotation presentation  
20 description, operands to the native computer instructions including  
21 text, the image annotation object being encoded according to a  
22 standard that defines data elements in object-oriented terms, the image  
23 annotation object having a unique tag, name, characteristics and  
24 semantics;  
25 annotating an original medical image with the text from the image annotation  
26 object; and  
27 displaying the annotated image on a visual display.

28  
29 71. The computer-accessible medium of claim 70, wherein the executable  
30 instructions further comprise annotation calculations and operations.



1 72. The computer-accessible medium of claim 70, wherein the displaying further  
2 comprises a displaying the annotated image in a browser.

3  
4 73. The computer-accessible medium of claim 70, wherein the processor further  
5 comprises a processor of a medical imaging device.

6  
7 74. The computer-accessible medium of claim 70, wherein the original image  
8 further comprises an original image contained with the image annotation object.

9  
10 75. An apparatus comprising:  
11 a processor; and  
12 an encapsulation of image annotation computer instructions, the computer  
13 instructions being native to the processor, the computer instructions  
14 being generated by a processor on another apparatus.

15  
16 76. A method of updating a medical imaging system with new annotation  
17 calculations, the method comprising:  
18 generating on a development system an image annotation executable that  
19 includes computer instructions that are native to a processor of the  
20 medical imaging system; and  
21 forwarding the image annotation executable through the Internet to the  
22 medical imaging system.

23  
24 77. The method of claim 76, wherein the image annotation executable further  
25 comprises an image annotation executable that package is a form selected  
26 from the group consisting of a browser-plugin and a dynamic link library.

27  
28 78. A method of updating a medical imaging system with new annotation  
29 calculations, the method comprising:  
30 receiving an image annotation executable that includes computer instructions  
31 of the new annotation calculations that are native to a processor of the  
32 medical imaging system; and

1           storing the image annotation executable in a location that is accessible to a  
2           viewer that is enable to access the image annotation executable.

3

4    79.    The method of claim 78, wherein receiving further comprises:  
5           receiving the image annotation executable from a manufacturer of the medical  
6           imaging system.

7

8    80.    The method of claim 78, wherein the medical imaging system further  
9           comprises a computer tomography medical imaging system.

10

11   81.    The method of claim 78, wherein the medical imaging system further  
12          comprises a magnetic imaging medical imaging system.